Quarterly Report
First Quarter 1994
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A. Task Objective: Algorithm Development for Global Mapping of Phycoerythrin Pigment, Dissolved Organic Matter, and Chlorophyllous Pigment

1. MODIS North Atlantic Test Site Establishment and Characterization

As previously reported, the MODIS North Atlantic Test Site has been established as originally proposed. The Test Site includes the New York Bight/Mid-Atlantic Bight/Gulf Stream/Sargasso Sea and is conveniently located north and east of GSFC/WFF. Characterization has been initiated by ship sampling, aircraft overflights, and analysis of historical data available from within the NASA AOL project since 1980. Much of the data obtained in the northwestern portion of the test site will be used for algorithm development in Case 2 waters.

Analytical activities during this Three Month Period included:

No airborne flights were conducted during this reporting period since the GSFC P-3B was undergoing an overhaul. Flight data from previous missions were analysed as reported below.

As reported earlier, flights were conducted to the northeast of GSFC/WFF in early April 1993 and in November 1993 to characterize the MODIS Test Site. In addition, these flights allowed the concurrent evaluation of the new EGG/Heimann sea surface temperature radiometers that were ordered during the last semi-annual period. The temperature sensor data evaluation indicated that the sensor had the requisite stability and accuracy needed to support the airborne active-passive ocean color measurements. Preliminary evaluation of these new surface temperature radiometers indicate that they are of excellent quality and yield very reproducible data. More evaluation is required to determine if the units can be used to support the validation of MODIS products and algorithms relative to sea surface temperature.

2. Selection of Case 1 Data Sets.

As listed in the semi-annual report, airborne active-passive ocean color data acquired within Case 1 oceanic regions with the NASA Airborne Oceanographic Lidar have now being screened for use in algorithm development. Several promising candidate data sets have been identified. In particular, AOL active-passive data in the northwestern Atlantic Ocean east of St. Johns , Newfoundland (obtained in 1989 as part of the Joint Global Ocean Flux Study of the North Atlantic Bloom Experiment) has displayed remarkable

quality and freedom from non-chlorophyllous backscatterers. This data is being used to establish the baseline radiance model to be used for the retrieval of phycoerythrin pigment (as well as DOM and pigment). Data sets from the Monterey Bay flights (Sept 1992) and Mid-Atlantic Bight (April 1989 and 1991) are now under evaluation.

B. Work Accomplished

1. In-situ and Airborne Optical Characterization of MODIS North Atlantic Test Site.

a. For the MODIS North Atlantic Test Site during August, 1993 cooperative overflights of EOS Interdisciplinary Team member, Dr. N. Blough, were conducted and the data has been analysed. There was excellent agreement between the airborne laser-induced DOM fluorescence and the ship-derived fluorescence. Due to overcast conditions these flights will not serve as a valuable data source for passive algorithm development.

b. For the MODIS North Atlantic Test Site during the next quarter (April 1994) cooperative overflights of the NSF/Univ. Md. Horn Point Environmental laboratory Land Margins Ecosystem Research (LMER) program will be conducted off the coast of Virginia and North Carolina. (See later section of this report.)

Additional validation of the retrieval of the absorption coefficient from DOM fluorescence is expected using this ship/airborne data. Previously, the DOM absorption from prior cooperative ship experiments (see below) was used to establish the levels of DOM fluorescence measured with the NASA Airborne Oceanographic Lidar in both the Atlantic and Pacific Oceans. These results have been publisheed [F.E. Hoge, R.N. Swift, J.K. Yungel, and A. Vodacek, Fluorescence of Dissolved Organic Matter: A comparison of North Pacific and North Atlantic Oceans during April 1991, JGR- Oceans 1993].

c. Completed Algorithm Theoretical Basis Document (ATBD) for retrieval of the accessory pigment, phycoerythrin. This document occupied a major portion of the work load for this quarter.

2. In Situ Optical Characterization of the MODIS North Atlantic Test Site.

As reported in a prior report, the continued characterization of the North Atlantic Test Site is partially described in a recent publication titled: "Inherent Optical Properties of the Ocean: Retrieval of the Absorption Coefficient of Chromophoric Dissolved Organic Matter from Fluorescence Measurements" by F.E. Hoge, A. Vodacek, and N. Blough, L&O 1993. Much of the data within this paper was obtained during cruises such as described above.

C. Anticipated Activities During Next Quarter.

a. During April 1994 flights will be conducted in cooperation with NSF's LMER and in conjunction with the DOE Ocean Margins program. In particular, airborne/ship experiments are planned in conjunction with Dr. Neil Blough aboard the Research Vessel Cape Henlopen. Likewise, Dr. Dan Repeta of Woods Hole will also be on the Research Vessel Colombus Iselin off the coast of Virginia/North Carolina during the next quarter. He will also be obtaining samples suitable for phycoerythrin analysis. Both Case 1 and Case 2 ocean color data will be obtained during these flights. Quality algorithm-development ocean color data are expected on pre-determined transects within the Mid-Atlantic Bight.

b. The lack of a 600nm band on MODIS-N is no longer considered a major problem. The phycoerythrin absorption bands occur at 495 and 545nm and can be satisfactorily covered by available MODIS bands as described below.

c. During the preparation of the ATBD, studies of available models, suggested that the retrieval of the phycoerythrin pigment at the absorption peaks of 495nm (phycourobilin, PUB) and 545nm (phycoerythrobilin, PEB) may possibly be achieved using the 490nm and 555nm MODIS bands. Such retrievals will require a highly accurate model to account for the significant amounts of chlorophyll and DOM absorption occurring simultaneously with the phycoerythrin absorptions.